

What Is Claimed Is:

- 1           1. A back-up heating system for a building having a first, enclosed  
2           compartment containing tooling for semiconductor fabrication, and a second,  
3           enclosed compartment containing electrically powered air handling equipment for  
4           constant exhaust of air from and intake of air into said first compartment, and a first,  
5           hot water heat exchanger having a first flow path, through which water heated by a  
6           boiler remote from said building is circulated, and a second flow path, through which  
7           building level heating water is circulated to absorb heat from said boiler-heated water  
8           prior to transfer, through at least one hot water radiation heater, of some of said heat  
9           to the air in said building, said back-up heating system comprising:
  - 10           a) a liquid cooled, internal combustion engine and generator for generating  
11           electricity during periods of primary power outage to operate said air handling  
12           equipment;
  - 13           b) a heat rejecting radiator for selective connection to receive liquid coolant  
14           from said engine, reject heat from said coolant and return said coolant to said engine  
15           when outside temperature is above said predetermined value;
  - 16           c) a second heat exchanger positioned within said building and having a third  
17           flow path, for selective connection, alternatively to said radiator, for circulation of  
18           liquid coolant from said engine, and a fourth flow path, for selective connection to  
19           receive said heating water from said heater prior to circulation of said heating water  
20           through said second flow path;
  - 21           d) first means selectively operable to control flow of said coolant between said  
22           radiator and said third flow path; and

23 e) second means selectively operable to control flow of said heating water  
24 between a direct connection from said heater to said second flow path and connection  
25 to said fourth flow path and thence to said second flow path.

1 2. The back-up heating system of claim 1 wherein said first means comprises  
2 a first valve.

1 3. The back-up heating system of claim 2 where said first valve is a three-way  
2 valve selectively actuatable to direct said coolant alternatively between said radiator  
3 and said third flow path.

1 4. The back-up heating system of claim 3 wherein said second means  
2 comprises a second valve.

1 5. The back-up heating system of claim 4 wherein said second valve is a  
2 three-way valve selectively actuatable to direct said heating water from said heater  
3 alternatively between said second flow path and said fourth flow path.

1 6. The back-up heating system of claim 1 and further including a booster  
2 pump positioned said fourth flow path and said second flow path to augment flow of  
3 said heating water from said fourth flow path to said second flow path when said  
4 second means is selectively operated to direct flow of said heating water from said  
5 heater to said fourth flow path and thence to said second flow path

1 7. The back-up heating system of claim 1 wherein said radiator is located  
2 outside said building to reject heat to outside air.

1 8. The back-up heating system of claim 1 wherein said air handling  
2 equipment and said at least one heater are located in said second building  
3 compartment.

1           9. In a manufacturing facility having a first building housing at least one fluid  
2   fired boiler and electrically operated pump for supplying boiler-heated water to a first  
3   flow path of a first heat exchanger in at least one other building when outside  
4   temperature is below a first predetermined value, and a first internal combustion  
5   engine powering an electrical generator to supply power for operating said pump  
6   during periods of primary power outage, said other building housing at least one hot  
7   water radiation heater with building level heating water circulated through the second  
8   flow path of said first heat exchanger to absorb heat from said boiler-heated water and  
9   through said heater, fabrication tooling which is susceptible to damage by exposure to  
10   temperature below a second, predetermined value and/or temperature drop in excess  
11   of a predetermined rate, electrically operated air handling equipment providing a  
12   constant exhaust of air from and intake of outside air into said other building, and a  
13   second, liquid cooled, internal combustion engine powering an electrical generator to  
14   provide electrical power to said air handling equipment during periods of primary  
15   power outage,  
16           a system for preventing temperature drop below said second, predetermined  
17   value and/or temperature drop in excess of said predetermined rate within said second  
18   building during periods of primary power outage when outside temperature is below  
19   said first predetermined value, said system comprising;  
20           a) a second heat exchanger having a third flow path with a first inlet and a first  
21   outlet, and a fourth flow path with a second inlet and a second outlet;  
22           b) first means for selectively directing liquid coolant from said second engine  
23   through said third flow path and back to said engine; and

24           c) second means for selectively directing said heating water from said said  
25 heater to said fourth flow path prior to circulation through said second flow path and  
26 thence back to said heater.

1           10. The system of claim 9 and further including a heat rejecting radiator  
2 positioned outside said second building and to which the second engine coolant line  
3 may be connected, and wherein said first means comprises a first valve selectively  
4 operable to direct coolant alternatively between said radiator and said third flow path  
5 of said second heat exchanger.

1           11. The system of claim 10 wherein said second means comprise a second  
2 valve selectively operable to direct said heating water from said heater alternately  
3 between a direct connection to said second flow path of said first heat exchanger and  
4 connection to said fourth flow path of said second heat exchanger and thence to said  
5 second flow path of said first heat exchanger.

1           12. The system of claim 11 wherein said first and second valves are three-way  
2 valves.

1           13. The system of claim 9 wherein said other building is divided into first and  
2 second, enclosed compartments, said first compartment being positioned vertically  
3 above said second compartment, said first compartment housing said air handling  
4 equipment, said heater and said second engine and generator, and said second  
5 compartment housing said fabrication tooling.

1           14. The system of claim 9 wherein said fabrication tooling comprises  
2 photolithography equipment used in the fabrication of semiconductor components.

1           15. The system of claim 9 wherein said first and second means each include a  
2 three-way valve, and said second means further comprises a booster pump.

1           16. The method of protecting temperature-sensitive production tooling from  
2 potentially damaging low temperatures and rapid temperature drops, said method  
3 being employed in a manufacturing facility having:  
4           a central utility plant housing at least one fluid-fired boiler with an electrically  
5 powered first pump for circulating water from said boiler to a first flow path of at  
6 least one, first heat exchanger when outside temperature is below a predetermined  
7 value, and a first internal combustion engine and generator for providing electrical  
8 power to said first pump when the latter is in use during periods of primary power  
9 outage, and  
10          one or more fabrication buildings each housing at least one of said first heat  
11 exchangers, a hot water radiation heater for flow of heating water through a second  
12 flow path of said first heat exchanger,, electrically powered air handling equipment  
13 for exhausting air at a predetermined rate from and drawing outside air at  
14 substantially said predetermined rate into the associated one of said fabrication  
15 buildings, a second, liquid cooled, internal combustion and generator for providing  
16 electrical power to said air handling equipment during periods of primary power  
17 outage, and a heat rejecting radiator connected to receive hot coolant from and return  
18 cooled coolant to said second engine during periods of primary power outage when  
19 outside temperature is above said predetermined level,  
20          said method comprising:  
21          a) providing a second heat exchanger having third and fourth flow paths in  
22 each of said fabrication buildings;

23           b) providing a first valve selectively operable to block flow of said coolant  
24   from said second engine to said radiator and directing said coolant through a first,  
25   alternate flow line to said third flow path;  
26           c) providing a second valve selectively operable to block flow of said heating  
27   water to said second flow path and directing said heating water through a second,  
28   alternative flow line to said fourth flow path, whereby said heating water absorbs heat  
29   from said coolant in said second heat exchanger;  
30           d) providing a third flow line connected to direct said heating water from said  
31   fourth flow path to said second flow path, whereby said heating water absorbs heat  
32   from said boiler heated water;  
33           e) observing the temperature outside said fabrication buildings during periods  
34   of primary power outage; and  
35           f) actuating both of said first and second valves when the observed  
36   temperature is below said predetermined value.

1           17. The method of claim 16 wherein said first and second valves are three-  
2   way valves.

1           18. The method of claim 16 and comprising the further steps of positioning a  
2   selectively operable booster pump in said third line and operating said booster pump  
3   only when said first and second valves are actuated.

1           19. The method of claim 16 wherein each of said fabrication buildings is  
2   divided into upper and lower, substantially exclusive compartments, and air is drawn  
3   by said air handling equipment into, and heated by said heater in said upper  
4   compartment for delivery to said lower compartment, said second engine and  
5   generator and said second heat exchanger are positioned in said upper compartment,  
6   said production tooling is positioned in said lower compartment, and said radiator is  
7   positioned outside said other building.